also of great value. The first three chapters, and some later ones, give a good account of the life-histories of the oyster, the clams (Mya and Venus), and the scallops (Pecten). One chapter deals with the ciliary mechanisms in some of these animals, and, being based on original observations, contains much that will probably be new to most zoologists. There is also an interesting chapter on bivalve molluscs in relation to human disease. Prof. Kellogg's book may confidently be recommended to all biologists interested in the economic side of their science. J. J.

THE FAUNA OF CEYLON.

Über die Geschichte der Tierwelt von Ceylon. By F. Sarasin. Zool. Jährbucher, suppl. 12, part i. Pp. 160. (Jena: G. Fischer, 1910.) Price 7 marks.

SINCE this elaborate piece of work embodies the results of the biological investigations undertaken by the Messrs. Sarasin in Ceylon during a protracted period, it has good claim to rank as the most authoritative attempt to explain the origin and relationships of the fauna of that island yet published. It is, however, really more than this, as it embraces a survey of the relationships and probable migrations of the faunas of south-eastern Asia generally, and their connection with that of Africa. Very valuable are the details given with regard to the geographical range of the various genera of mammals, reptiles, molluscs, planarians, and worms constituting the Ceylon fauna. Ceylon, which long formed a portion of "Gondwanaland," and is thus of great antiquity, appears to have been isolated from the Indian mainland during the whole or the greater portion of the Pleistocene period.

From this antiquity—in which the island presents a striking contrast to Celebes—the fauna of Ceylon displays unmistakable evidence of a very mixed origin, both as regards space and time. Not fewer than three epochs of connection between the Oriental region and Africa have left their impress on the Ceylonese fauna, one of these periods of union being pre-Cenomanien, while a second was Siwalik. Special emphasis is laid by the author on the part played during the Eocene in the evolution of the fauna of Ceylon by the irruption of the Deccan traps, which for a considerable period formed an impassable belt, dividing the peninsula into a southern area, including Ceylon, and a northern area. Even after the cessation of volcanic activity, communication between these two areas was greatly restricted, consisting of one track on the western and another on the eastern side of the peninsula, and even then practicable only to animals capable of withstanding a considerable amount of drought. The Siwalik connection the author considers took place by way of Baluchistan, Persia, Arabia, and Syria, or possibly to the south of Arabia by way of Socotra; and the author agrees with Dr. Arldt that the connecting area was originally clothed with forest, and that the affinity of the faunas of the African forest-zone, the Malay countries, and southern India and Ceylon may be accounted for by the subsequent deforestation of the tract, and the retreat of the animals to districts where suitable conditions still remained.

Dr. Sarasin likewise admits a former connection between Ceylon and eastern Africa and Madagascar; but considers that a chain of islands will explain the facts of the case, and that recourse to a continental "Lemuria" is quite unnecessary. He likewise accepts a connection with the Malay islands, probably by way of the northern part of the Bay of Bengal, and has also something to say with regard to the South American affinities of the Indo-African fauna. In Ceylon itself the older forms of life, such as planarians, worms, and molluscs, have a very different distributional history from those of the later mammals, and thereby present another contrast to Celebes, where the advent of all was synchronous. A valuable digest of the previous literature concludes this excellent piece of work. R. L.

THE PHILOSOPHY OF EXPERIENCE.

The Principles of Pragmatism: a Philosophical Interpretation of Experience. By H. Heath Bawden. (Boston and New York: Houghton Mifflin Co., 1910.) Price 1.50 dollars net.

THIS is an altogether admirable exposition of the views which are usually associated with the names of Peirce, James, and Dewey in America, and Schiller in England. It does not claim to construct a system, but only to show how we may establish the basal conceptions of a new philosophy of experience.

Pragmatism is the reaction from a speculative philosophy which was out of touch with the affairs of men. The practical man follows with interest the development of a working hypothesis in science, but is impatient of speculations on the infinite and eternal. He values thinking, but he insists that thought shall keep close to experience. He has no use for empty abstractions. The metaphysician has spun a universe out of his own inner consciousness, and tries to make the facts fit his system. The pragmatist seeks the cooperation of the man of science in constructing a philosophy which shall be accurate in method and shall fit the facts.

Philosophy must start, not with a great First Cause or absolute, but with concrete, workaday human life. It must try to understand experience here and now, and from that as a basis proceed to work outward to the metaphysical problems. All the problems of origin and destiny need to be re-stated in terms of present experience. Such a procedure, if it does not much reduce the number of mysteries which lie about us, will at least save us from multiplying them unnecessarily.

The question of immortality, for instance, turns on the nature of individuality. In spite of all the arguments—theological, intuitional, revelational, ethical, and what not—most persons find their faith in a future life scarcely more than a wish. Why? Because the self for whose immortality they hope is an unreal abstraction.

"The self is conceived as a particularistic entity, with barriers to other selves. While, in society, indi-

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viduals are recognised to be functions of each other, at death they are supposed to shrivel into isolated and alien units."

The only future that is possible is an immortality of function. An organism is nothing but a centre or focus through which the world-energy operates. When the organism is lost in what we call death, the function may well enough go on in terms of more subtle forms of energetic activity (*cf.* Prof. James's little book, "Human Immortality").

Perhaps, if a criticism may be ventured, modern "psychology-without-a-soul" has become *too much* afraid of being metaphysical. A function must be a function of something. If there is an act, there must be an actor who is, in a way, greater and more real than the act. A soul-entity, then, is justified. It is as reasonable to posit it as to posit a surviving "function."

But the volume is full of deep and careful thinking, and is suggestive and stimulating even in its more questionable doctrines. The analysis of consciousness, and the chapters on the test of truth and on mind and matter, are particularly good.

SOME GERMAN MATHEMATICAL TREATISES.

(1) *Einführung in die Vektoranalysis, mit Anwendungen auf die mathematische Physik.* By Prof. Richard Gans. Zweite Auflage. Pp. x+126. (Leipzig: B. G. Teubner, 1909.) Price 3.60 marks.

(2) *Die Vektoranalysis und ihre Anwendung in der theoretischen Physik.* By Dr. W. v. Ignatowsky. Teil I. Die Vektoranalysis, pp. vii+112. Teil II. Anwendung der Vektoranalysis in der theoretischen Physik. Pp. iv+123. (Leipzig: B. G. Teubner, 1909–10.) Price 6 marks.

(3) *Vorlesungen zur Einführung in die Mechanik raumerfüllender Massen.* By Prof. Alexander Brill. Pp. x+236. (Leipzig: B. G. Teubner, 1909.) Price 8 marks.

(4) *Funktionentafeln mit Formeln und Kurven.* By Prof. Eugen Jahnke and Fritz Emde. Pp. xii+176. (Leipzig: B. G. Teubner, 1909.) Price 6 marks.

(5) *Die Zentrifugalkraft.* By Prof. Friedrich Poske. Pp. 80. (Berlin: Julius Springer, 1909.) Price 3 marks.

(6) *Interpolationsrechnung.* By Prof. T. N. Thiele. Pp. xiii+173. (Leipzig: B. G. Teubner, 1909.) Price 10 marks.

(1) THE simplified system of vector analysis promoted by Gibbs and Heaviside has met with such general acceptance in Germany that treatises and memoirs on subjects of mathematical physics are now often hardly intelligible to readers who do not possess some familiarity with the notations and processes of the calculus in question. A demand has thus arisen for elementary expositions limited to what is absolutely necessary for physical purposes. The first book on our list, now in its second edition, is written mainly with a view to the electrical applications. It deals in a clear and simple fashion with the fundamental operations, and then passes on to the discussion of vector-fields. An interesting chapter on "tensors," which have a bearing on the theories of stress and of quadratic moments, is added. The work closes with a few elementary applications to hydrodynamics and electromagnetism. It may be commended as giving in a very brief compass almost all that is of importance to the physical student.

(2) This work consists of two parts. In the first of these vector analysis is developed from its foundations as an independent discipline, without any reference to Cartesian or other special geometrical coordinates. The author claims some degree of novelty for his methods of exposition, we think with justice. In particular the intrinsic nature of Hamilton's operator ∇, whether as applied to a scalar quantity, or by scalar multiplication to a vector, or by vector multiplication to a vector, is here explained with great insight and (we believe) originality. The passages in question may be recommended to the notice of those who have felt the inadequacy of the usual Cartesian treatment of the matter. The theorems of Green and Gauss naturally present themselves for discussion, and, as in the preceding work, a chapter is added on tensors. The second volume contains a number of applications to elasticity, hydrodynamics, electricity, and crystalline reflection.

(3) This is a course of lectures on the dynamics of continuous systems, written from a special point of view. The inspiration is derived from Hertz, but the author prefers to employ Gauss's principle of least constraint rather than the Hertzian law of the "straightest path." The treatment is somewhat academic, in the sense that stress is laid on unity of method rather than on the specific interest of the various topics discussed, but it is marked by clearness and great mathematical elegance. The subjects considered include the kinetics of rigid bodies and of fluid and elastic media, and, finally, the electromagnetic theory of light. On one point a protest should, in the opinion of the present writer, be entered. The notion that the apparent potential energy of a dynamical system may be accounted for as the kinetic energy of latent internal motions is here, as in many recent Continental writings, attributed too absolutely to Hertz. If nowhere stated so explicitly, perhaps, it must have been present to the mind, not only of Lord Kelvin, but of all students of his various expositions of the theory of gyrostatic systems, to say nothing of the well-known "kinetic theory" of elasticity.

(4) This is intended as a supplement to the ordinary tables of mathematical functions. Of recent years a great deal of work has been done, especially in this country, in tabulating the functions which occur in various important problems of mathematical physics, but the results are scattered in the proceedings of societies and in scientific journals, and are often unavailable, and even unknown, to those who have most need of them. The authors of the present treatise have collected a number of such tables, and have appended explanations of the notations, and lists of the important formulæ. The whole is brought within a moderate compass by restricting the entries to four significant figures; this is, of course, ample for most physical purposes, and more than sufficient for graphical representation. We are

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